

Producing Hydrogen: The Thermochemical Cycles

Efficient production of hydrogen without increased greenhouse gas emissions is the key to achieving the “hydrogen economy” envisioned by the National Hydrogen Initiative. As the lead laboratory for the Department of Energy’s Office of Nuclear Energy, Science and Technology, the Idaho National Engineering and Environmental Laboratory is assuming a major role in developing technologies to produce hydrogen using nuclear energy. One of the most

promising of these technologies uses thermochemical cycles to produce hydrogen.

What Are Thermochemical Cycles?

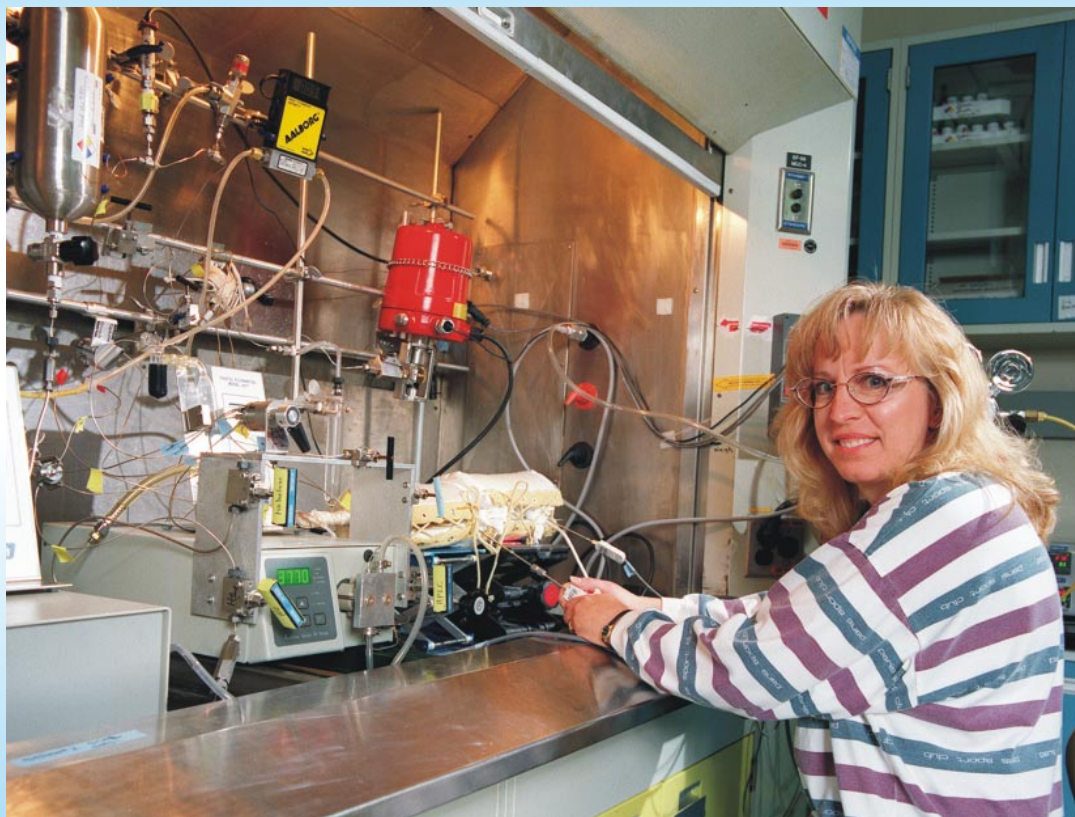
Thermochemical cycles combine heat with chemical processes to split water into its hydrogen and oxygen components. Several cycles have been demonstrated at the laboratory scale. For example, one cycle uses sulfur, iodine and heat to split water into hydrogen and oxygen.

INEEL: Applying Nuclear Science to the Thermochemical Cycles

INEEL has initiated an internally funded project to move demonstration of the thermochemical cycles from the laboratory to larger-scale engineering demonstrations. INEEL’s work focuses on overcoming technical barriers and applying nuclear energy to create the heat necessary to fuel the cycles.

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INEEL's thermochemical cycles project includes tasks to:

- Identify materials that can withstand the high temperatures and corrosive conditions required in many thermochemical cycles.
 - Develop efficient separation methods for complex chemical mixtures.
 - Improve kinetics.
 - Improve the efficiency of electrochemical steps included in some of the cycles.
- Specific INEEL thermochemical cycles projects include:
- Possibly integrating thermochemical water splitting as one of the hydrogen production processes to be conducted by the Very High Temperature Reactor that could be operating at the INEEL site by around 2015.
 - Working as a subcontractor to General Atomics on the conceptual design of an integrated nuclear reactor/sulfur-iodine cycle for hydrogen production.
 - Participating with other national laboratories in working with the

Department of Energy's Office of Nuclear Energy, Science and Technology on an R&D plan that will lead to the eventual demonstration of hydrogen production using nuclear energy.



The INEEL is one of the U.S. Department of Energy's multiprogram national laboratories, and is managed by Bechtel BWXT Idaho, LLC.